·临床研究·

锥形束CT造影在颞下颌关节盘穿孔的诊断价值

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摘　要：【目的】评价锥形束CT(CBCT)造影检查对颞下颌关节盘穿孔的诊断价值。【方法】回顾分析了2013年12月至2023年1月期间临床诊断为颞下颌关节骨关节病(TMJOA)，且同时进行了CBCT造影检查及开放手术的患者。将CBCT造影诊断结果与开放手术探查金标准比较，得出真假阳性和真假阴性关节例数，从而评价CBCT造影诊断关节盘穿孔的整体准确性。【结果】共90例患者106侧关节符合本研究纳入标准，其中男性10例，平均年龄36.4岁；女性80例，平均年龄42.6岁，单侧病变74侧，占比82.22%，双侧病变16例，占比17.78%。其中造影剂显影良好94侧，占比88.68%，造影剂显影不良12侧，占比11.32%。CBCT造影结果明确诊断为关节盘穿孔75侧，占比70.75%，手术探查确认穿孔75侧；5例造影剂显影不良，影像诊断考虑可能穿孔，探查确认穿孔5例；影像诊断真阳性率100%；CBCT造影结果明确诊断不存在关节盘穿孔19侧，造影占比17.92%，手术探查确认无穿孔19侧，真阴性率73.08%，7例造影剂显影不良，影像结果未报关节盘穿孔，手术探查存在穿孔7侧，假阴性率26.92%。【结论】CBCT造影对颞下颌关节盘穿孔具有较高的诊断准确率，可为临床提供可靠的影像学依据。

关键词：颞下颌关节；骨关节病；关节盘穿孔；锥形束CT；关节造影
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Diagnostic Value of Arthrography Combined Cone-beam Computed Tomography in Temporomandibular Joint Disc Perforation

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Abstract:【Objective】To evaluate the diagnostic value of cone-beam computed tomography (CBCT) arthrography for temporomandibular joint disc perforation.【Methods】A retrospective analysis was conducted on patients who were clinically diagnosed with temporomandibular joint osteoarthrosis (TMJOA) and underwent CBCT arthrography and open surgery between December 2013 and January 2023. The diagnostic results of CBCT arthrography were compared with the gold standard of open surgical exploration to determine the number of true and false positive and negative cases, thereby evaluating the overall accuracy of CBCT arthrography in diagnosing disc perforation.【Results】A total of 90 patients (106 joints) met the inclusion criteria of this study, including 10 males with an average age of 36.4 years and 80 females with an average age of 42.6 years. Among them, 74 joints exhibited unilateral lesions (82.22%), and 16 joints exhibited bilateral lesions (17.78%). Among these, 94 joints (88.68%) showed good contrast medium visualization, while 12 joints (11.32%) showed poor contrast medium visualization. CBCT arthrography clearly diagnosed disc perforation in 75 joints

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(70.75%), and surgical exploration confirmed perforation in 75 joints. In 5 cases, poor contrast medium visualization was observed, and the imaging diagnosis suggested possible perforation, with surgical exploration confirming perforation in 5 cases; the true positive rate of imaging diagnosis was 100%. CBCT arthrography clearly diagnosed the absence of disc perforation in 19 joints (17.92%), and surgical exploration confirmed the absence of perforation in 19 joints, with a true negative rate of 73.08%. In 7 cases, poor contrast medium visualization was observed, and the imaging results did not report disc perforation, but surgical exploration revealed perforation in 7 cases, with a false negative rate of 26.92%. 【Conclusions】CBCT arthrography demonstrates high diagnostic accuracy for temporomandibular joint disc perforation and may provide reliable imaging evidence for clinical decision-making.

Key words: temporomandibular joint; osteoarthrosis; disc perforation; cone-beam computed tomography; arthrography

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颞下颌关节紊乱病(temporomandibuar disorders,TMD)是口腔颌面部最常见的疾病之一，其临床表现为关节杂音、下颌运动异常和关节区及咀嚼肌疼痛等[1-4]。而颞下颌关节盘穿孔是TMD的重要的类型之一，是实施颞下颌关节开放性手术的主要指征之一，其诊断对于确定治疗计划有重要意义[5-13]。口腔锥形束CT(cone-beam computed tomograpgy, CBCT)平扫能够直观地显示髁突的位置及其骨质改变以及关节凹骨质的变化，对于TMD的诊断有重要价值[14]。但是由于CBCT检查不能显影关节盘，不能明确关节盘是否穿孔。磁共振(magnetic resonance image, MRI)由于能够显示关节盘的形态和位置，对颞下颌关节(temporomandibuar joint,TMJ)盘穿孔有一定诊断价值[15]。由于关节盘、关节软骨、皮质骨、滑液等在MRI T1加权像均表现为低信号，盘穿孔诊断比较困难。而在T2加权像，关节滑液为高信号，如果关节液贯穿上下腔，可以诊断盘穿孔。但如果关节液较少，盘穿孔也很难判断。而利用关节上腔造影技术结合CBCT检查，能够根据造影剂在上下腔的分布特征明确推断关节盘的位置、形态以及是否穿孔[14-20]。本研究选取在我院行CBCT造影检查，并进行TMJ开放性手术的患者，经由CBCT造影诊断有无关节盘穿孔，评价其对TMJ穿孔的诊断价值。目前没有大样本研究关节上腔造影结合CBCT诊断关节盘穿孔的报道。

1　材料与方法

1.1　病例资料

回顾性分析2013年12月至2023年1月期间，由中山大学附属口腔医院临床诊断为颞下颌关节骨关节病(temporomandibular joint osteoarthritis, TMJOA)的患者，患者同时拥有CBCT造影检查结果及开放性手术探查验证结果。病例纳入标准：我院电子影像诊断系统及电子病历系统均有本研究所需患者临床信息。本研究遵守《赫尔辛基宣言》，并经中山大学附属口腔医院IIT管理系统申请立项，项目编号：GHKQ-202606-L003；经中山大学附属口腔医院伦理委员会批准，免除受试者知情同意，伦理批号：GHKQ-202606-L03-01。

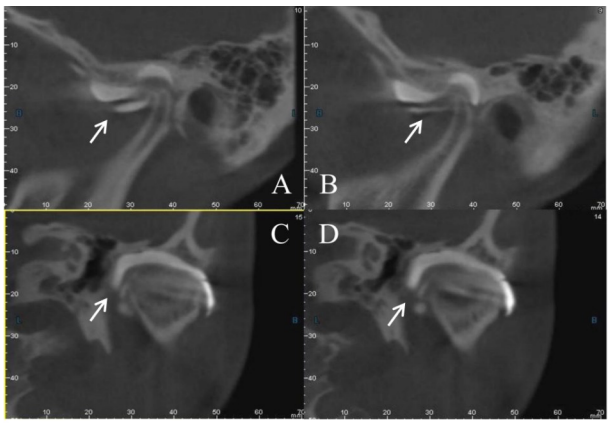
1.2　研究方法

1.2.1　临床特征分析　通过查阅我院电子影像诊断系统，收集颞下颌关节造影且行CBCT检查患者名单，进而通过查阅我院电子病历系统，收集其中行手术治疗患者，从而收集符合纳入标准患者，记录的数据包括：性别、年龄，CBCT造影时间及检查结果，手术探查时间及手术探查结果，手术位置。

1.2.2　锥形束CT造影检查及图像数据采集　CBCT影像学数据由以下设备采集：CBCT设备品牌型号(中山大学附属口腔医院)：NewTom VGi。扫描参数设置如下：110 KV，10~15 mA，FOV：15×12 cm，分辨率：0.3 mm。所有患者在造影前均已行CBCT平片检查，临床诊断为颞下颌关节骨关节病。TMJ上腔造影在20 g/L利多卡因局麻下进行，关节上腔穿刺成功后行关节灌洗，然后注入造影剂600 g/L泛影葡胺2 mL，于10 min内行CBCT检查。CBCT检查包括开口位和闭口位。所有患者在检查中及检查后无任何并发症发生。

1.2.3　锥形束CT影像学分析　所有患者图像采集后上传图像归档和通讯系统，重建扫描数据后可获得开、闭口时TMJ轴位、矢状位及冠状位图像。每

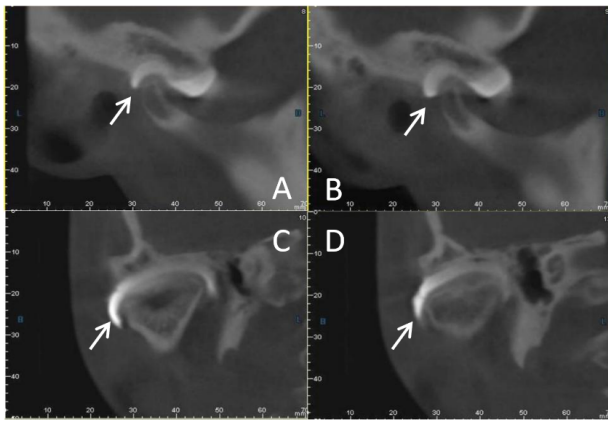
个病例均由2名高年资放射科诊断医师对CBCT造影的图像进行阅片分析,按照诊断标准判断关节盘是否有穿孔;关节盘穿孔诊断标准如下:①阳性:关节上下腔均见造影剂呈分层样分布(图1);②阴性:造影剂呈单层分布(图2);③无法明确诊断:造影剂显影不良或未见显影。当两名诊断医师意见不一致时,则第三位放射科医师参与共同讨论决定。



A: Closed mouth sagittal view; B: Mouth open sagittal view; C: Closed mouth coronal view; D: Mouth open coronal view. The contrast agent exhibits double layers distribution (white arrow).

图1 阳性病例的锥形束CT图像(关节盘前移位伴穿孔)

Fig. 1 Cone-beam computed tomograpgy image of a positive case (anterior disc displacement with perforation)



A: Closed mouth sagittal view; B: Mouth open sagittal view; C: Closed mouth coronal view; D: Mouth open coronal view. The contrast agent exhibits single layer distribution (white arrow).

图2 阴性病例锥形束CT图像(关节盘前移位不伴穿孔)

Fig. 2 Cone-beam computed tomograpgy image of a negative case (anterior disc displacement without perforation)

1.2.4 *开放手术验证* 通过查阅电子病历系统手术记录内容,明确患者关节盘是否存在关节盘穿孔。

1.3 统计学分析

采用IBM SPSS 16.0软件对临床特征和影像学表现进行统计学分析。对于计数资料,以例数(百分比)表示,使用Fisher精确检验进行统计分析。当$P<0.05$时表示差异有统计学意义。

2 结 果

2.1 患者一般资料

共90例患者106侧关节符合本研究纳入标准。其中男性10例,年龄21岁~69岁,平均年龄36.4岁;女性80例,年龄17岁~82岁,平均年龄42.6岁(表1)。

表1 患者一般资料

Table 1 Demographic characteristics of the patients

[n,n(%)]

Variable	Value
Patients	90
Temporomandibular joints	106
Male	10 (11.1)
Average age of males/year	36.4
Female	80 (88.9)
Average age of females/year	42.6
Unilateral lesion	74
Bilateral lesions	16

2.2 锥形束CT造影诊断结果

阅读本研究患者的CBCT造影结果,其中造影剂显影良好94侧,占比88.68%(造影剂显影良好侧数/造影总侧数×100%),造影剂显影不良12侧,占比11.32%(造影剂显影不良侧数/造影总侧数×100%)。

CBCT造影结果明确诊断为关节盘穿孔75侧,占比70.75%(CBCT造影结果明确诊断为关节盘穿孔侧数/造影总侧数×100%);CBCT造影结果明确诊断不存在关节盘穿孔19侧,占比17.92%(CBCT造影结果明确诊断不存在关节盘穿孔侧数/造影总侧数×100%);5例CBCT造影剂显影不良,影像诊断考虑可能穿孔,占比4.72%(CBCT造影显影不良但结果判定关节盘穿孔侧数/造影总侧数×100%);7例造影剂显影不良,影像结果未报关节盘穿孔,

占比6.60%（CBCT造影显影不良但结果未报关节盘穿孔侧数/造影总侧数×100%；表2）。

表2　锥形束CT造影诊断结果

Table 2　Imaging results of cone-beam computed tomograpgy arthrography　[n(%)]

Imaging results	Joints (percentage)
Definite perforation	75 (70.75)
Definite non-perforation	19 (17.92)
Poor contrast opacification (non-perforation)	7 (6.60)
Poor contrast opacification (Suspected perforation)	5 (4.72)
Total	106 (99.99)

2.3　锥形束CT造影结果与开放性手术所见结果比较

CBCT造影结果明确诊断为关节盘穿孔75侧，占比70.75%，手术探查确认穿孔75侧；5例造影剂显影不良，影像诊断考虑可能穿孔，探查确认穿孔5例；影像诊断真阳性率100%（手术探查确认穿孔例数/CBCT造影诊断穿孔总例数×100%）；CBCT造影结果明确诊断不存在关节盘穿孔19侧，造影占比17.92%，手术探查确认无穿孔19侧，真阴性率73.08%（手术探查确认未穿孔例数/CBCT造影诊断未报穿孔总例数×100%），7例造影剂显影不良，影像结果未报关节盘穿孔，手术探查存在穿孔7侧，假阴性率26.92%（手术探查确认穿孔例数/CBCT造影诊断未报穿孔总例数×100%；表3）。

以术中探查结果作为诊断金标准，对CBCT造影诊断关节盘穿孔的诊断准确性进行评价。在106侧颞下颌关节中，术中证实关节盘穿孔87侧，未穿孔19侧。CBCT造影诊断关节盘穿孔80侧（包括明确穿孔75侧及疑似穿孔5侧），均经术中证实为关节盘穿孔；术前CBCT造影诊断未报穿孔26侧，其中19侧术中证实未穿孔，7侧因显影剂显影不良，术前影像学诊断未报关节盘穿孔，但术中探查证实存在关节盘穿孔。在术前CBCT造影诊断存在关节盘穿孔组别中，诊断准确率高达100%（手术探查确认穿孔例数/CBCT造影诊断穿孔总例数×100%）。而在术前CBCT造影诊断未报关节盘穿孔组别中，诊断准确率则为73.08%（手术探查确认未穿孔例数/CBCT造影诊断未报穿孔总例数×100%），共7侧诊断出现错误，分析造成诊断错误的原因，这7侧均有显影剂显影不良的共性（表3）。以上结果提示：在临床实践中，术前CBCT造影诊断为颞下颌关节盘穿孔的影像学诊断结论可靠性强；然而，对于造影剂显影不良且术前诊断未报穿孔的病例，应注意存在关节盘穿孔的可能。

表3　锥形束CT造影结果与开放性手术所见结果比较

Table 3　Comparison between cone-beam computed tomograpgy arthrography and surgical findings

(n)

Surgical findings	Imaging results of CBCT arthrography			
	Perforation group		non-perforation group	
	Definite diagnosis	Poor contrast	Definite diagnosis	Poor contrast
Perforation	75	5	0	7
non-perforation	0	0	19	0
Diagnostic accuracy rate/%	100.00		73.08	

3　讨　论

颞下颌关节盘穿孔是TMJOA的主要表现之一，是关节盘移位的发展结果。文献报道颞下颌关节盘移位的患者，其盘穿孔发生率约为5%～15%[16]。关节盘穿孔是实施颞下颌关节开放手术的重要指征之一，因此准确诊断颞下颌关节盘穿孔非常重要[5, 7-9, 13, 21]。

CBCT作为一种低辐射剂量的检查手段在口腔颌面部临床应用日益广泛。在TMJ疾病的诊断中,CBCT检查可以通过对关节间隙的改变、髁突和关节凹骨质的变化,判断TMJ的病变范围及程度。由于CBCT固有的对软组织低分辨率的缺陷,CBCT并不能直接显示关节盘的形态和位置,因此无法直接判断是否盘穿孔。MRI检查由于可以直接显示关节盘及关节区其他软组织的影像,可以准确、清楚显示关节盘的位置和形态,并且没有辐射危害,因而在TMJ病变的诊断上具有优越性。但是MRI对于关节盘穿孔的诊断率较低,其准确性依赖于关节腔积液的多少和临床经验的判断,对于关节盘穿孔的诊断率有待进一步的提高[22]。而CBCT结合TMJ造影能够非常直观、准确地判断是否存在盘穿孔。相对于MRI对盘穿孔3%~80%的诊断率,CBCT造影检查对于盘穿孔的诊断率达到95%以上,是一种非常可靠的检查手段。CBCT造影诊断盘穿孔基本上没有假阳性结果;其中需要特别关注的是注射显影剂困难患者,显影剂虽位于关节上腔但CBCT结果往往显示显影剂充盈不良,其原因可能是关节盘穿孔处纤维组织粘连导致造影剂在关节上下腔之间难以流动。CBCT造影检查的主要缺点是需要进行关节腔穿刺,有一定的创伤。然而在造影剂注射前进行关节腔灌洗,也是TMD的一种治疗方法,对TMD有一定的疗效。因此CBCT造影对怀疑盘穿孔的患者,仍不失为一种简单易行、成本较低的可靠诊断方法。

总之,临床实践中,虽然MRI在关节盘形态、位置的显示上具有CBCT不可比拟的优越性,但存在关节盘穿孔诊断易漏诊的缺陷。而CBCT造影检查诊断TMJ盘穿孔有非常高的准确性,并且简单易行,具有较大的临床价值。其主要的缺点在于有一定的创伤。但其对患者造成的辐射损伤处于临床可接受的安全范围内;同时,在有经验的医生的操作下,穿刺创伤较小;况且行关节腔穿刺,在造影剂注入关节腔之前可行关节灌洗,有助于减轻TMD患者局部疼痛及张口受限,可起到一定的治疗作用。

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